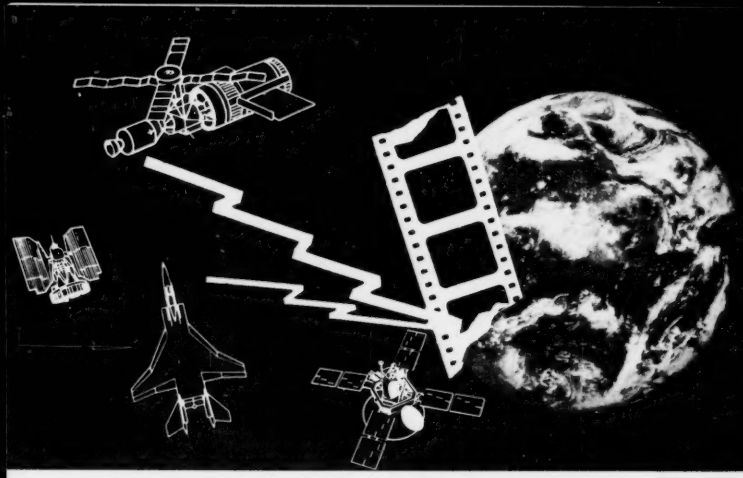

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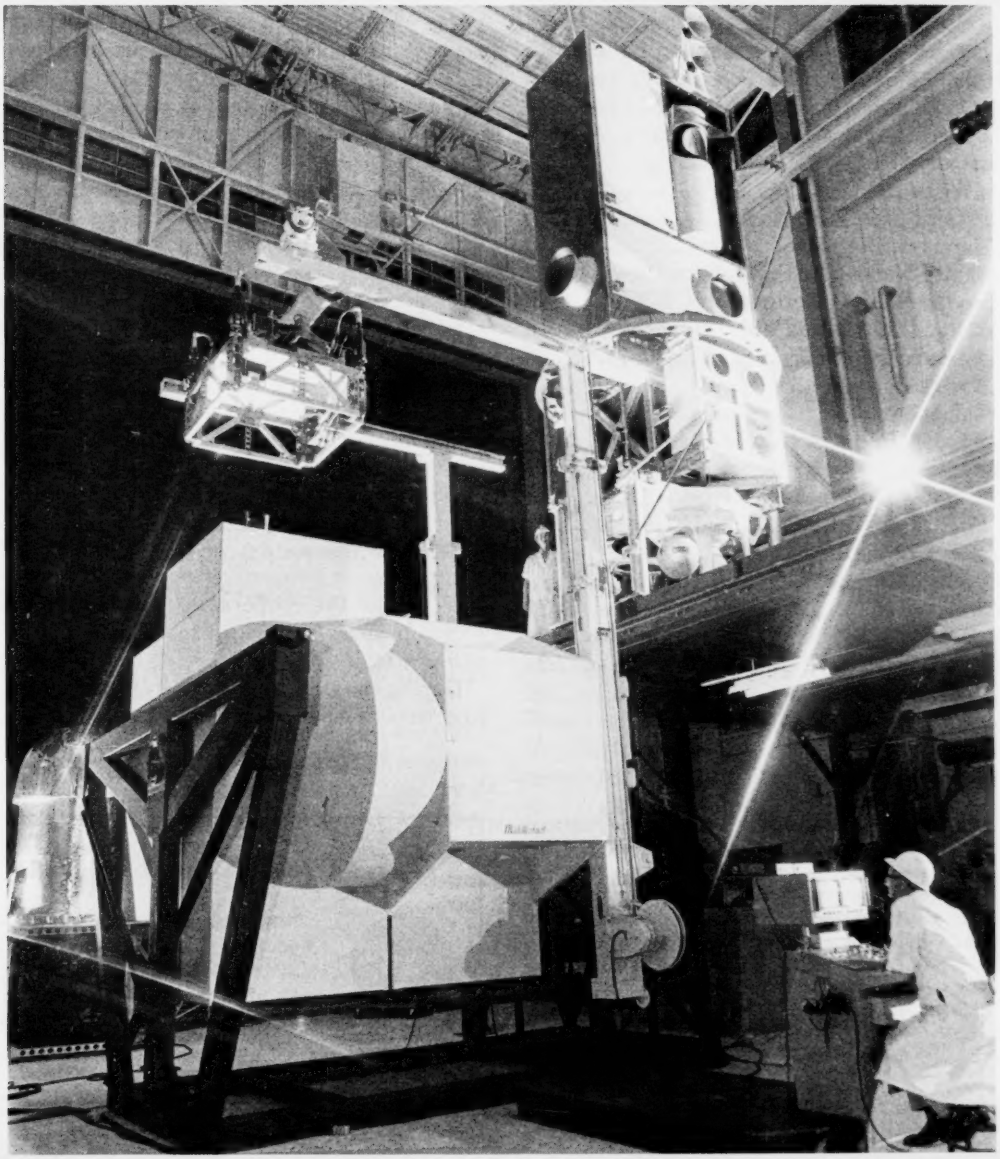

TABLE OF CONTENTS

Letter from Washington 2
Monthly NASA Highlights 4
Low to Get Rockefeller Award 8
Energy Experiment for ASTP 8
Lee Says ASTP Is on Schedule 9
Spacecraft Built to Cut Shuttle Costs 12
JPL Writer Honored 13
MSFC Facilities Modified 13
Fuel Technology Study 13
Gray Cites Aerospace Technology Effects 14
Windmill Contracts Let 14
Low Cost Corner 15
Space Stamps Popular 16
Firms Get LST Roles 16
Pickering Receives Marconi Award 17
Small Business Contracts Rise 17
Women's Week Held 17
Homes to Get Space Wiring 18
Gordon Harris to Retire 18
Richard Smith Named MSFC Deputy Director . 19
Special Skylab Awards Ceremony at MSFC ... 19
NASA Writer Interviews Fords 19
Skylab Data Processed 20
Cernan Writes Space Article 20
Saturn Stands Modified 20
Jaffe Heads I.A.F. 21
Radio-Television 21
Hydrogen Study Contract Let 22
Balloon Flights Aid HEAO 22
Headquarters Press Releases 23
NASA in Food Picture 23
Lunar Sample Exhibits 23
Michoud Support Chosen 24
NASA Tech Briefs 24
Patents and Inventions 26
1974 Launch Schedule 27
Your 1¢ Worth from Space 28

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LETTER FROM WASHINGTON

December 10, 1974

Dear Colleagues:

I would like first of all to wish you and your families a very Merry Christmas season and a happy and successful New Year.

We have had a very good year in 1974 in terms of what we have accomplished in our aeronautics and space programs; and we have the plans and the resources to make 1975 equally productive and significant for our nation and the Earth's peoples, and professionally rewarding for each of us.

This eventful year began with Skylab in orbit and brought the successful conclusion of this challenging and highly valuable program. In Skylab we learned what we needed to know at this time to plan for the effective use of scientists and astronauts in Earth orbit in the future. But we also learned much more: we gained fantastic new knowledge about the Sun; we added to our understanding of the resources of Earth; and we took the first small steps towards new industries in space—the manufacture of materials which cannot be made except in the weightless environment of orbit.

Even as we completed Skylab, we moved ahead rapidly in 1974 with Spacelab, which is one of our most important international cooperative efforts to date and which we expect will be one of the Space Shuttle's most productive "payloads". Spacelab will give us and the cooperating countries a small but versatile space station for many different scientific and practical uses.

During the past year NASA spacecraft have visited three planets, Venus, Mercury, and Jupiter.

COVER

GSFC's new Low Cost Modular Spacecraft (LCMS) built to reduce costs when the Shuttle begins operating. See Page 12.

Pioneer 10 and 11 and Mariner 10 were assigned exceedingly difficult missions. They have produced tremendous increases in our knowledge of the Solar System in which we live. They are still producing.

On the night of Dec. 2, we re-christened Pioneer 11 as Pioneer Saturn. That night, using Jupiter's gravity, the spacecraft set a new course that will take it close to the ringed-planet Saturn in 1979.

Coming back to Mariner 10, I would like to mention that in addition to its scientific and engineering achievements it has proved a valuable object lesson on how NASA, our aerospace industry contractors, and participating scientists can cooperate effectively to cut the costs of space exploration. Mariner 10 was "designed to cost," and demonstrated that it can be done. This is a lesson we need to take to heart in the years just ahead.

We have also done well in the space applications field in 1974. ERTS is continuing to return data and is demonstrating the potential of economic returns measured in the hundreds of millions of dollars per year. Our new weather satellite in synchronous orbit—SMS—is giving us remarkable pictures of nearly half of the globe at one time; our new experimental communications satellite—ATS-6—is relaying TV programs to low-cost community-type antennas. The revolution in global and domestic communications made possible by space technology is gathering momentum. The beneficial impact on education, health, sea and air navigation, and indeed every aspect of human life, will be great! Current opportunities for the private sector to further develop and use this new technology are almost without limit: witness the fact that in 1974 we launched the first two commercial domestic communications satellites.

In aeronautics we are making steady progress on many fronts. We have, for example, seen growing interest in applying the principles of the supercritical wing to improving the performance and efficiency of military and civilian aircraft.

We are also successfully developing new technology for noise abatement; advanced engine requirements; civil and military short-haul and long-haul aircraft; special military aircraft needs; aviation safety; and reduced aircraft fuel consumption. We are making a special effort to demonstrate how advanced technology—including super-critical wing technology—can be applied to the needs of what is called "general aviation"; that is, the many aircraft in business and private use.

In 1974, we initiated comprehensive, long-range planning studies called "Ooutlook for Aeronautics" and "Outlook for Space". These studies are to be completed by the middle of 1975.

I am proud to say that, thanks to our many years of aeronautical and space R&D, we have greatly increased our ability to help our country find new engineering solutions to current and long-range energy problems. For many decades now men of vision have dreamed of and worked on the wireless transmission of electricity. In September of this year, at Goldstone, CA, we demonstrated a small but significant step forward in this field.

This is just one example of the many ways in which we are helping to find new sources for clean, cheap energy here at home or in Earth orbit.

I want to mention, too, the significant progress we have made in the past year in our Equal Employment Opportunity programs, and the success we are having in recruiting capable women and minority candidates to fill important management and professional positions.

Finally, I want to say I am pleased with the way our recent reorganization of Headquarters is working out. It has increased our ability to serve and give general guidance to our all-important Field Centers.

Those are some general ideas, and a few examples, indicating the kind of progress we have made in 1974.

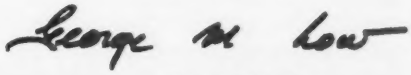
Incidentally, in July of 1974, NASA ACTIVITIES began publishing a regular feature called Monthly NASA Highlights. This is a carefully written review and deserves your attention if you have not already discovered it.

The end of this year also marks the end of the first half of the decade of the Seventies. From this halfway point, at year's end 1974, the view ahead is encouraging, and full of promise.

In the second half of the Seventies we will join our Soviet colleagues in Earth orbit; bring the Space Shuttle into operation; design and build payloads for it; win new understanding of the Universe; intensify our exploration throughout the Solar System and perhaps find life on Mars; gain economic returns from our communications, weather and resources satellites; maintain America's lead in aeronautical research and technology; and in general add to the momentum of our national and international advance into a glorious new age for Humanity, an Age of Opportunity in Earth Orbit and Beyond that is just beginning.

Keep up the good work in 1975! And again, best wishes for a joyous holiday season.

Sincerely,



George M. Low
Deputy Administrator

MONTHLY NASA HIGHLIGHTS

DELTA ROCKET LAUNCHES TRIPLE PAYLOAD

Three satellites were launched by a single NASA rocket from Vandenberg Air Force Base, California, on Nov. 15. It was the first three-satellite launch for a Delta rocket. Spain's first satellite, Intasat, and an amateur radio satellite, OSCAR, were carried inside the Delta shroud as "piggyback" payloads of the ITOS-G mission.

The ITOS-G (Improved Tiros Operational Satellite-G) is designed to maintain the operational satellite system that for more than eight years has provided regular global observations of cloud systems and other environmental features for the weather forecast and warning services of the United States and other nations. Radiometers onboard the spacecraft will provide visible and infrared images of cloud cover; snow, and ice and the sea surface; and will collect information on temperatures and moisture in the atmosphere. After launch by NASA, ITOS-G becomes the operational responsibility of the National Oceanographic and Atmospheric Administration.

The Intasat mission is a joint, cooperative space research program between Spain and the United States. It is designed to measure the total electron content of the ionosphere, including the annual variations by altitude. The satellite will provide data for some 30 to 40 experimenters around the world.

The other piggyback satellite was AMSAT-OSCAR-7, a communications spacecraft developed by the Radio Amateur Satellite Corp. (AMSAT), for noncommercial public service and educational use by the amateur radio community. OSCAR stands for Orbiting Satellite Carrying Amateur Radio. AMSAT is a non-profit scientific corporation headquartered in Washington, DC, with a world-wide membership. This was the seventh in a series of amateur radio satellites launched since 1961. The first four were launched as secondary payloads by the Department of Defense. Two Oscars have been launched by NASA.

The Oscar-6, first amateur satellite to achieve long life operations, is still in operation after two years in space and has been used by some 2,400 radio amateurs in 87 countries and all 50 states. The amateurs transmit through the satellite as it passes within radio range to other amateurs who might be tuned in to the Oscar frequency.

Oscar satellites are the only type designed for free access internationally. The Oscar will provide high school and college students with a better understanding of space science by permitting them to participate directly in demonstrations through local amateur radio operators. It will demonstrate, by means of stations in the amateur service, the feasibility of using satellites in low orbits with small user terminals for remote communications between medical centers and isolated areas, aeronautical, maritime and land mobile communications, direct satellite-to-home voice broadcasting to simple amateur receivers and other similar applications.

NASA LAUNCHES 19th INTELSAT FOR THE COMMUNICATIONS SATELLITE OPERATION

The Intelsat IV F-8 commercial communications satellite was successfully launched by an Atlas Centaur launch vehicle from Cape Canaveral, FL, on Nov. 21. This is the 19th Intelsat launched by NASA since 1965. Of the four unsuccessful attempts, two were due to apogee motor anomalies and two were launch vehicle anomalies. Except for the two launch vehicle failures, all other NASA launch support objectives have been met.

The global system of communications satellites currently consists of four Intelsat IV satellites operating in synchronous orbit over the Atlantic, Pacific, and Indian Oceans and a spare Intelsat III or IV satellite over each area. The Intelsat IV F-8 will replace the Intelsat III spare in the Pacific Ocean region. Each Intelsat IV satellite has a communications capacity of about 4000 voice-grade circuits; plus television, and a design life of seven years.

The International Telecommunications Satellite Consortium, known as Intelsat, was established under international agreements in 1964. Membership in Intelsat requires accession by a government to the agreement among governments and the signing of the companion operating agreement by the government or its designated public or private telecommunications entity. Fourteen nations were the original signatories of this international joint venture created to establish the global commercial communications satellite system. Presently, the 86-member-nation Consortium represents approximately 95 percent of the telecommunications traffic of the world.

The Communications Satellite Corporation, COMSAT, is a privately-owned U.S. communica-

tion carrier company incorporated in 1963 to establish a commercial communication satellite system in conjunction and cooperation with other countries of the world and to make available to all countries of the world the services of the system.

The growth of international communications by satellite is due primarily to the continued expansion of the worldwide network of Earth stations which work with the global system of satellites serving the Atlantic, Pacific, and Indian Ocean areas and to the growing reliance of foreign countries on satellites for communication.

HIGH ENERGY ASTRONOMY OBSERVATORY (HEAO) DESIGN PROGRAM RESTARTED

HEAO management is making strenous efforts to complete a low-cost program initially involving three observatories, each having the same basic spacecraft design but differing scientific instrumentation. About 80 percent of the HEAO system designs have flown on previous satellites. In some cases, the operational requirements of the spacecraft were dictated by the proven hardware available.

The HEOA program is NASA's first concentrated effort to study cosmic ray, X-ray, and gamma-ray sources in deep space. The HEAO spacecraft will concentrate on such major recent astronomical discoveries as neutron stars (the remnant of a supernova explosion), pulsars (which rotate rapidly and have intense magnetic fields), and black holes (completely collapsed stars with such tremendous gravitational force that light or other radiation cannot escape).

In January, 1973, the HEAO program was suspended for at least one year because of cost limitations placed on the agency. By February, 1973, a restructured program that could fit the reduced funding levels was formed and definition work begun.

Under the restructured program, HEAO observatories A, B, and C, considered Block I vehicles, will be launched in 1977, 1978, and 1979. Not all of the experiments planned for the original HEAO program can be carried on the smaller spacecraft designed for the restructured program. Therefore, a program (called Block II) involving HEAO spacecraft carried by the Space Shuttle is under development. Under this plan, if implemented, the HEAO-C observatory, launched by an expendable booster in 1979, would be retrieved later by the Shuttle, returned to Earth and refurbished as the first Block II observatory with a new payload.

All three HEAO spacecraft are designed around the same structure to save costs. The rear, or equipment, module contains the experiments to be carried on individual missions. The ease with which new experiments can be fitted onto the equipment module not only is cutting costs on the current program, but also could result in the basic HEAO design being carried over into different Earth orbiting programs.

MARINER 10 CORRECTION MANEUVER SUCCESSFUL

The sixth trajectory correction maneuver (TCM) for the Mariner 10 spacecraft was successfully completed on Oct. 30, 1974. The maneuver, which had a programed burn of 84 seconds for a Delta V of 14.65 meters per second, was achieved without complication and changed the spacecraft trajectory from a Mercury flyby at 265,000 kilometers to a periapsis of 5,560 kilometers from Mercury's surface. The aim point for the Mercury III encounter is 2,360 kilometers, and therefore a seventh TCM is needed and is scheduled for late December or early January, 1975. The Mercury III encounter is expected to occur at 5:45 p.m. EST on March 16, 1975.

The spacecraft is in good condition, with about 227 grams (500 millipounds) of gas remaining. It is in a modified solar sailing mode using approximately 0.5 grams (1 millipound) of the attitude control gas per day, well below original design levels. The outlook for a successful Mercury III encounter is good.

PIONEER 11 TO FLY BY JUPITER

The Pioneer 11 spacecraft, launched April 6, 1973, was still on its way to the planet Jupiter as November ended and was expected to make its closest approach on Dec. 3. All spacecraft subsystems and science instruments were operating normally.

Pioneer 11 entered the Asteroid Belt in August, 1973, and exited in March, 1974. As with Pioneer 10, no concentration of smaller particles was observed.

During early 1974, a number of possible target points were studied to determine the encounter trajectory that would best complement the information on Jupiter obtained by Pioneer 10 in December, 1973. On April 19, 1974, Pioneer 11 was retargeted to a trajectory that will pass the leading edge of Jupiter, close to the South Pole. Unlike the Pioneer 10 spacecraft which is heading out of the solar system, the Pioneer 11 will be deflected by Jupiter into an orbit that encounters the planet Saturn in 1979.

Astronomers have studied Jupiter through telescopes since 1610, but no one had seen Jupiter at close range until Pioneer 10 transmitted several hundred pictures back to Earth. Pioneer 11 will give the first view of Jupiter's polar regions.

BRITISH SATELLITE LAUNCHED BY NASA ON A DELTA ROCKET

The Skynet IIB, a British defense communications satellite, was launched by a three-stage Delta launch vehicle from Cape Canaveral, FL, on Nov. 22, 1974. The Skynet IIB is the second of two second-generation operational communications satellites launched by NASA for the United Kingdom. The first mission, Skynet IIA, was launched on Jan. 18, 1974, but did not achieve orbit because of a launch vehicle failure.

The first generation Skynet A and B satellites were developed by the United Kingdom International Defense Communication Satellite Program and successfully launched by NASA on Delta vehicles on Nov. 21, 1969, and August 18, 1970, respectively. The Skynet IIB spacecraft was produced by Marconi Space and Defense Systems Limited for the Communications Satellite Program being conducted by the Ministry of Defense in the United Kingdom. The Skynet IIB satellite will be located in geosynchronous equatorial orbit above the Indian Ocean to provide in-orbit X-band military communications between designated Earth stations.

FIRST MEETING ON MOONS OF THE SOLAR SYSTEM

The great age of planetary satellites was the 17th Century when the four longest moons of Jupiter were discovered by Gallileo and the major satellites of Saturn were discovered by Huygens and Cassini. In the 300 years since then, the moons have been for the most part neglected. But in the last three years new observations from the ground and spacecraft have renewed astronomers' interests.

When 150 scientists met in September at Cornell University, Ithaca, NY, for the First International Conference on Planetary Satellites, it seemed clear that the subject of satellites had become almost as important as the subject of planets. While most of the study of planetary satellites has been directed toward the Earth's moon, which appears to be a unique object with a complex origin, it was not a principal topic of the conference. The two tiny moons of Mars, Phobos and Deimos were discussed at more length because Mariners 7 and 9 had obtained good pictures of them and acquired data which raised questions about their composition. But most of the conference was devoted to the satellites of the outer planets, particularly Jupiter, Saturn, and Uranus.

The larger moons of these planets are found in systems with such regular orbits that they look almost like miniature solar systems. If the planetary satellites conference had been held 20 months ago, there would have been little discussion of the atmospheres of the satellites of Jupiter. But now Io (one of Jupiter's 12 moons) is known from Pioneer 10 measurements to have a trace atmosphere, and many scientists expect that Ganymede and Europa do, too.

The outer satellites are so far away, at least eight times the distance from the Earth to Mars, that more spacecraft measurements will almost certainly be required before planetary scientists can reach a consensus on the properties of the satellites. The planets of the outer solar system are clearly different from the planets we have come to know in the last few years. Whereas the rocky inner planets have proven to be laden with enduring records, perhaps even still-preserved primordial material, the outer planets are mostly gaseous and unlikely to have any hard specimens recording their history. The moons of the outer solar system may be more enlightening remnants of that region than the planets.

IRAN TO BUILD ERTS GROUND STATION

Iran has signed a Memorandum of Understanding with the United States under which it will build a ground station to receive pictures and scientific data directly from NASA's Earth Resources Technology Satellites (ERTS).

Under the agreement, Iran will pay the full cost of constructing and operating the new facility, which will be located near Teheran, while NASA will guarantee free access to the ERTS-1 satellite for as long as it continues to operate and to the ERTS-2 (scheduled for launch in January, 1975) at least during its design life of one year. After that period, NASA will have the option to establish some cost-sharing arrangements.

In exchange for direct access to the ERTS data, Iran will make copies of the imagery and computer-compatible tapes available to NASA. The data will complement similar data gathered by U.S. ground stations at Fairbanks, AK, Goldstone, CA. and Greenbelt, MD.

In addition to the new Iranian facility; ERTS ground stations are already in operation at Prince

Albert, Canada, and Buiaba, Brazil, with a third station under construction at Fucino, Italy. Information on the Earth's natural resources returned by the ERTS-1 has already been distributed to investigators in the U.S. and 37 foreign countries. Scientists are using the data to study land forms, forests, crops, oceans, pollution, water runoff and urban land use.

WORKING GROUP DISCUSSES NEW SOLAR PHYSICS MISSIONS

A Solar Physics Working Group held a three-day meeting at Marshall Space Flight Center during the week of Nov. 6 to discuss ideas for new advanced solar physics missions.

The group was chaired by Dr. Adrienne Timothy, program scientist for the Apollo Telescope Mount and Solar Physics Spacelab at NASA Headquarters. Dr. Timothy has participated in the Skylab ATM Experiment SO54, X-ray Spectrographic Telescope.

SOLAR PHYSICIST AT MSFC—Dr. Adrienne Timothy, NASA Headquarters, chaired a meeting of the Solar Physics Working Group at the Marshall Space Flight Center recently. The physicist, born and educated in England, is shown above with Herman P. Gierow, Director of the Payload Stuides Office at MSFC, with a cutaway model of the Space Shuttle.

Among the topics discussed at the meeting was a proposal to convert the Apollo Telescope Mount backup hardware to an early solar physics payload for the Spacelab.

FORMER ASTRONAUT WINS SENATE SEAT

John H. Glenn, the United States' first orbiting astronaut, won a U.S. Senate seat from Ohio in a landslide victory over Mayor Ralph J. Perk of Cleveland in the elections held on Nov. 5. Glenn will succeed Senator Howard M. Metzenbaum, who occupied the seat vacated by Attorney General William B. Saxbe when he resigned to take the Cabinet post.

Glenn made his first try for the Senate in 1964, but withdrew because of an ear injury. When he tried a second time in 1970, he was defeated by Metzenbaum in the primary race.

LANGLEY ADVANCES DATA RECORDER TECHNOLOGY

A solid state data recorder with no moving parts, developed by NASA, may replace magnetic tape recorders aboard spacecraft in the 1980s. Successful tests of exeprimental models of the recorder may mean that they will be used in the future as aircraft flight data recorders and as electronic control systems in mass transit systems.

These recorders offer high reliability since the failure of moving parts accounts for 70 percent of magnetic tape recorder malfunctions aboard spacecraft. Additional advantages would be realized from a solid state data storage system providing a potential for reliable systems operation for one to 10 years longer.

The present experimental model has a 60,000-bit data storage capacity. However; the overall objective of the present Langley Research Center program is to provide a solid state data storage system with a 100,000,000-bit capacity by 1978. If successful, flight versions of such a recorder could be available at the end of this decade.

PATENT LICENSING CONFERENCE

The Patent Licensing Conference held in Salt Lake City, UT, on Nov. 19 was sponsored jointly by NASA, the University of Utah, and the University of New Mexico's Technology Application Center.

As part of NASA's ongoing program to encourage the transfer of space-developed technology to non-aerospace uses, this conference was aimed primarily at business and industrial executives in the Rocky Mountain region. The program included a review of the NASA patent licensing program, examples of technology transfers to the business and industrial community, and the role of Regional Dissemination Centers and NASA Field Center Patent Counsels in helping individuals obtain patent licenses.

An added feature of this particular conference was an address by Senator Frank E. Moss of Utah, Chairman of the Senate Aeronautical Space Sciences Committee.

LOW TO GET ROCKEFELLER AWARD

Dr. George M. Low, NASA's Deputy Administrator and the aeronautical engineer who managed the Apollo Moon landing program, has been selected to receive the 1974 Rockefeller Public Service Award for Administration, recognized as the most prestigious private honor for veteran civil servants.

Dr. Low was one of five top career officials chosen to receive the $10,000 tax-free award. It was scheduled to be presented to him by President Ford at a luncheon ceremony at the Mayflower Hotel in Washington Dec. 4.

Dr. Geo. M. Low

Announcement of Dr. Low's selection was made by President William G. Bowen of Princeton University, where the awards program is administered as a public trust.

In making the announcement, it was recalled that Dr. Low, whose entire professional career has been in government service, initiated the negotiations with the Soviet Union that resulted in agreement to cooperate in space science, including the Apollo-Soyuz joint space flight scheduled for next year. He also played a leading role in the Mercury, Gemini and Apollo programs.

The annual awards have been financed since 1952 to honor excellence in career civil service by John D. Rockefeller, III, who was expected to be present at the ceremony on Dec. 4. In setting a basis for selecting awardees, he wrote: "Courage, sensitivity, vision; these, I believe, are the qualities that make for greatness in men who serve the people***."

Other NASA officials who have received the award are the late Dr. Hugh L. Dryden; Deputy Administrator, in 1962; Abe Silverstein, Director of Lewis Research Center, in 1968; and Dr. Robert R. Gilruth, Director of the Manned Spacecraft Center (now Johnson Space Center), in 1969. Willis H. Shapley, Associate Deputy Administrator, was presented the award in 1956 while he was with the Bureau of the Budget.

Dr. Low was born in Austria in 1926, came to the United States in 1940 and became a naturalized citizen in 1945. During World War II, he served in the U.S. Army from 1944 to 1946. He attended Rensselaer Polytechnic Institute and received a Bachelor of Aeronautical Engineering degree in 1950.

He joined NASA's predecessor, the National Advisory Committee for Aeronautics, as an aeronautical research scientist in 1949. In 1958, when NASA was organized, he transferred to Headquarters as Chief as Manned Space Flight, and was resposible for the Mercury and Gemini programs and Chairman of the special committee that formulated the original plans for the Apollo manned lunar landing.

In 1964, he transferred to the Manned Space Center at Houston as Deputy Director, having the overall responsibility for the Gemini and Apollo spacecraft efforts, as well as future program development, flight operations, and flight crew operations. In 1967, he was named Manager of the Apollo program, shortly after the spacecraft fire in January of that year, and played a leading part in making manned space vehicles fireproof.

He returned to Headquarters as Deputy Administrator in 1969 and demonstrated leadership in planning and executing all of the Apollo missions. During the time he directed the program, five manned flights were made, including Apollo 11, the first mission to land men on the Moon.

In addition to his duties as Deputy Administrator, Dr. Low, in March of 1974, was appointed to serve as Acting Associate Administrator for Center Operations, a post now held by Elmer S. Groo.

Among the numerous awards he has received are NASA's Outstanding Leadership and Distinguished Service Medals, the Arthur S. Flemming Award, American Astronautical Society Space Flight Award, Louis W. Hill Space Transportation Award, Goddard Memorial Trophy and the National Civil Service League's Career Service Award for Sustained Excellence.

UNDERSTANDING ENERGY

One of the astronomy experiments to be performed aboard the Apollo spacecraft during the joint U.S.-USSR space mission next July may lead to a better understanding of how energy is generated.

The object of the experiment, called MA-048 X-ray Observation, is to provide high-resolution celestial maps of sources and background radiation in the so-called "soft" X-ray region of the spectrum.

The information obtained could contribute to an understanding of how these X-rays emit particles such as electrons. Understanding of similar processes in the Sun contributed to the development of ways to use nuclear energy.

During Skylab, some X-ray sources were mapped, but the ASTP exepriment will map sources in a slightly different range.

The first astronomical X-rays were discovered in 1962. To date, about 160 sources have been observed in the higher energy ranges.

PROJECT MANAGER SAYS ASTP IS ON SCHEDULE

Chester M. Lee Tells Space Club
Mission Will Carry 27
Experiments

(Editor's Note: NASA's next manned mission is the Apollo Soyuz Test Project, a joint U.S. Soviet Earth orbital rendezvous/docking effort scheduled for next July. At a meeting of the National Space Club in Washington, an ASTP status report was delivered by Capt. Chester M. Lee, NASA ASTP Project Director. Excerpts from his remarks follow:)

ASTP Emblem

We are now approximately eight and a half months from the targeted launch date of July 15, 1975. We are meeting our projected key milestone date on schedule and, in some instances, are ahead of schedule; and I can report with confidence that our prospects of meeting that launch date and having a successful mission are excellent.

It is, I think, fairly evident that, as the mission date approaches, interest in the objectives and value of it has increased. Today, I would like to give you a brief overview of the project, its status, and add some observations of various aspects of the program.

First, let me address the objectives of the program. The primary objective is to conduct space experiments to test the technical requirements and solutions for compatibility of systems for rendezvous and docking of future manned spacecraft and stations. More specifically, this includes the testing of a compatible rendezvous system in orbit, verifying the techniques of crew transfers, and intercontrol center activities, as well as testing of universal docking assemblies.

It also includes the gaining of experience in conducting joint flights by U.S. and USSR spacecraft, including, in case of necessity, rendering aid in an emergency. You are all aware that the later Apollo and Skylab flights appeared to become fairly routine and simple. I am certain that you are also aware that this appeared to be so only because of the tremendous amount of preplanning, testing and training that went into these programs.

Certainly all this experience has been poured into ASTP, but let me emphasize that the introduction of another country into the space rendezvous adds considerable complication—tracking networks are different, therefore orbital parameters may have some bias that must be accounted for; spacecraft hardware is different; atmosphere of spacecraft are different; language difference can play an important role; requirements of specific spacecraft attitudes to accommodate particular spacecraft hardware capabilities must be accounted for; communications both air-to-air, air-to-ground and control center must be planned in great detail and exercised.

In essence then, it is much more than blasting off from the launch pad and meeting another spacecraft in space. We are not, I repeat, not establishing with this mission a rescue capability as such, although we could bring back the cosmonauts in our spacecraft. We are, however, verifying the system and technique and gaining valuable experience for meeting and joining up with the spacecraft and another country in space. This is fundamental to any future rescue or joint space operations.

Mission Profile

The mission profile to carry out these objectives can be described very briefly. The Soyuz will be launched first; with Apollo scheduled for liftoff approximately seven and a half hours later. The decision to launch the Soyuz first was a mutual agreement to maximize the successful insertion into orbit of both spacecraft. With the greater payload and recycle capability of the Apollo Saturn IB booster, greater launch dispersions can be accommodated, and Apollo will have five successive days of launch opportunity.

The Apollo will conduct the rendezvous maneuver, with station keeping and docking with Soyuz to occur approximately 52 hours after Soyuz liftoff. The docked period will last approximately 42 hours, to be followed by undocking and a redocking with the Soyuz docking system in the active condition. The two spacecraft will than make the final undocking and conduct several joint experiments involving the unique capability of two spacecraft.

The Soyuz will make preparations for landing and returning to Earth on the sixth day. Apollo will continue to orbit for another five days, conducting a number of unilateral experiments and landing on the ninth day near Hawaii.

During the docked phase, four crew transfers are planned—allowing each crew member to visit the other spacecraft. Should the Apollo launch be delayed until the second or third day, the rendezvous will be effective in 30 hours and the remainder of the mission will be the same. A launch on the fourth or fifth day will mean a reduction in the joint docking

time to about 26 and 9 hours, respectively—still enough to accomplish the primary objective of the mission.

On the U.S. side, the hardware involved in the Apollo spacecraft, modified somewhat for this mission (i.e., Docking Module and Docking System controls), is now at Kennedy Space Center undergoing test and checkout preparations. The Docking Module, which is essentially an airlock, has just completed altitude chamber tests at Johnson Space Center and is now at KSC. The flight and backup Docking Assemblies are currently in Moscow undergoing joint fit and functional tests with the Soviets' Docking Systems. The Saturn IB booster is at KSC with the S-IB first stage now out of storage and undergoing inspection and early preps. The S-IVB and Instrument Unit will come out of storage in December.

Hardware on Schedule

We have been informed that the Soyuz spacecraft (two of them) are in final stages of manufacturing and assembly and will be shipped to their launch site shortly after the first of the year, where preliminary tests and preparations will commence.

In short, the hardware for the mission is on schedule and we have essentially completed all the major checks.

Many people have asked why the U.S. is building the Docking Modules. There are a number of reasons, but basically it comes down to accommodating our spacecraft O_2 (pure oxygen) atmosphere at five pounds per square inch, the Soviet O_2 and N_2 (oxygen and nitrogen mixture) atmosphere at 14.7 pounds per square inch. Future U.S. spacecraft, i.e.: the Shuttle, will operate at essential 1 atmosphere O_2 & N_2. Also, we examined very closely the modifications of the top deck to accommodate the docking system. This would have been a major modification of the Apollo top deck which includes the earth landing system. The conclusion was that it was much simpler and cheaper to build the docking module.

Questions have been asked numerous times as to how much are the Soviets spending on this joint venture. I don't know of any way to equate their costs in dollars. I would point out for you, however, that the Soviets are committing two complete spacecraft and launch vehicles to the July, '75, mission. The backup one will have to be refurbished even if not used.

Further, they have flown two unmanned Soyuz vehicles testing various features for ASTP, and have announced that they will fly a precursor manned Soyuz on the ASTP profile prior to our joint mission. It is difficult to equate their expenditures in dollars, but my personal view is that they are committing resources equivalent at least to ours.

Before leaving the subject of hardware, I would like to say a few words on the experiment package that we are carrying on this mission. We are carrying 27 individual experiments, five of which are joint experiments with the Soviets. These experiments cover the fields of science; space processing and manufacturing; applications and life sciences. Several of the experiments are completely funded—except for spacecraft integration costs—by a foreign government. For example, the Federal Republic of Germany is funding an electrophoresis experiment to four to five million marks.

A number of the experiments are follow-on to Skylab experiments. We expect this package not only to provide some very valuable data, but also to provide additional valuable experience in experiment management and requirements established techniques for Shuttle. In an effort to hold down costs for the experiment package, we have changed our management and documentation requirements from that used during Apollo Skylab.

In essence, we have relaxed our assurance of reliability and perhaps to some degree reliability in order to reduce experiment costs. Let me assure you, however, that we have not relaxed experiment safety criteria.

ATS-6 to Be Used

During this mission we are also planning on extensive use of the ATS-6 relay satellite to improve our communications and TV coverage. Without this ATS-6 relay our orbital coverage would be approximately 16 percent. This is about half of what Skylab got because we are flying a lower Earth orbit—approximately 140 nautical miles. ATS-6 relay has also permitted us to plan more extensive live TV coverage, particularly during the docked phase with the Soviets.

Another new TV feature we are planning is real time coverage of the astronauts in the Command Service Module pre-launch and during the launch phase. We are currently examining a safety problem with the camera mounting having to do with an unusually hard landing impact, but we hope to resolve this shortly.

Now that we are essentially through the hardware manufacturing modification and qualification phase, our schedule ahead concentrates a great

deal on the operational training of both flight and ground crew training. We will be emphasizing correctness of procedures, communications techniques and handling of unexpected contingencies.

Crew training has progressed very well, and we are really just starting specific flight controller training. Today a number of Soviet Flight Controllers are in Houston for several weeks of joint training. Our Flight Controllers have completed a similar training period in Moscow. We have at least four major simulations involving both control centers and personnel scheduled before the launch. Parallel to this, of course, will be the meticulous and thorough vehicle checkout progressing along at KSC. We anticipate rolling out to the PAD about the end of March, 1975. A number of joint Working Group meetings will also be conducted throughout the coming months.

"***We will continue to review all aspects of mission success and, most important, crew safety. ASTP is no different from any previous NASA program—crew safety has been and will continue to be paramount. With the U.S. hardware we have applied all of our knowledge and previous experience to insure maximum results and safety.

With regard to the Soyuz spacecraft, we recognized very early in the planning that we could not reasonably expect to be as intimately familiar with that hardware. Obviously the period of vulnerability of the U.S. crew to any Soyuz failure is during the final stages of docking and undocking, as well as the docked period.

I do not mean to infer that failures that have occurred at other periods of flight, such as reentry, etc., are not of great interest—because insofar as they reflect the overall safety of the Soyuz, they are considered in that context.

However, our efforts have been concentrated in these joint periods, and I would also note that the docked portion of the mission has been structured to be fairly static. Our approach then has been to postulate types of failures that were potentially catastrophic—for example, fire, uncontrolled thrusting, decompression, collision or structural impact. We are assessing each of these to determine what can be done to alleviate the situation.

Report Exchange Agreed

To provide the necessary information for such an assessment, we agreed with the Soviets to exchange safety assessment reports in the critical areas as we mutually see them. In addition, we are also making independent assessments of such critical areas and will separately address each potential catastrophic hazard we identify.***

We are satisfied that no unacceptable or unusual safety risk has been uncovered.

The subject of technology transfer also receives, and properly so, considerable attention. First let me say that transfer of technology has never been an objective of the project. In fact, from the beginning the program has been structured to minimize this aspect. It is true that we have exchanged functional drawings schematic and descriptive of Apollo and Soyuz spacecraft—but at least, in my view, this is not technology transfer because not only are these system descriptions generally available, but also the important thing is that no manufacturing and assembly technique or process has been revealed.

Based on the Soviet's accomplishment in navigation with their interplanetary probes, I cannot imagine that they don't have an inertial guidance system—but assuming they don't—I know of no information we have exchanged in our briefings, training, etc., that would provide them the necessary know-how to design and build such a system.

In the design of the docking system, each country in its own way designed its system to meet a common specification. The U.S. has followed an electrical-hydraulic principle. Based on all our joint testing, both sides have met the specification criteria.

One could probably say that in carrying out the joint effort necessary we have provided the Soviets some insight into our management techniques. However, I am not at all certain because of their government structure that such techniques are applicable. Therefore, I see little, if any, technology transfer occurring in this program.

Again with regard to the value of the ASTP to the United States, I have already stated why I believe it is important to acquire the necessary experience and basic information for joint space operations. I have in mind not only future rescue capabilities, but also joint space exploration. Obviously, space exploration and utilization is expensive. One way to alleviate this cost is in joint ventures.

Keeping up Momentum

ASTP also provides the opportunity to keep our momentum in the interval before Shuttle starts flying. It is easy for some to cast this aspect off—but NASA has developed a very fine government/industry/university team. Operations contribute a

great deal to keeping such a team viable.

Much has been said about the political aspects. Certainly it is a part—perhaps small—of the "detente". From my observations I feel that it has provided an opportunity to establish communication. Our working relations are not with the politicians, but are with the engineers, scientists and technicians. I know if you examine the documentation in detail that you will find these people have constantly worked toward the optimum engineering solution considering the capabilities and limitations of both sides. For example, the Soviet agreed to operate their spacecraft at 10 pounds per square inch rather than their normal 14.7 psi in order to permit a more rapid crew transfer by eliminating the need for prebreathing of pure oxygen to prevent "bends".

This also enables the U.S. to eliminate the need for an environmental control system in the Docking Module—at considerable cost saving. It meant a significant modification to the Soyuz spacecraft.

The program has provided a window—however small—into a part of the Soviet society. With this window and resulting knowledge and understanding, there is some contribution to the detente.

In summary, ASTP is on schedule for a July, 1975, mission, which I have high confidence will be a successful and worthwhile program for the United States.

SPACECRAFT BUILT TO CUT COSTS OF SHUTTLE PROGRAM

GSFC Engineers Design Orbiter That Can Be Repaired in Space

A new vehicle to orbit the Earth on a long-time basis without having to be brought back to Earth for repairs has been developed by a team of NASA engineers and small manufacturers from the Goddard Space Flight Center area.

Called a Low Cost Modular Spacecraft (LCMS), the device can be carried into orbit by rocket or the Space Shuttle. When necessary, it can be recovered by the Shuttle and held in position on a special platform that fits into the cargo bay of the Shuttle Orbiter. While in this position, a special mechanism is used to remove malfunctioning subsystems or experiments and replace them with new units brought up from Earth.

An initial mechanical model of the spacecraft cost about a quarter of a million dollars. Working in connection with the Shuttle when the latter begins operational flights in the early 1980s, officials believe projected savings could run into the hundreds of millions of dollars over a period of 10 years in comparison with present methods of orbiting spacecraft that, once launched, cannot be recovered or repaired.

It is anticipated that some 14 satellite missions projected up to 1984 could readily use the LCMS approach to extend their useful life times, reduce costs on a basis of the invested dollar, and substantially increase the amount of data which are returned to Earth.

The LCMS consists of an instrument assembly and spacecraft assembly. These are joined together with a transition ring in such a manner that the scientific experiments or Earth Resources instruments are carried above the ring and the spacecraft subsystems below the ring. The spacecraft subsystems consist of attitude control, power, communications and data handling, and propulsion modules.

Goddard engineers developed the idea originally in attempting to find a way to keep drastically rising costs of expendable spacecraft from continuing to mount. The concept was to develop instrumentation in modules or separate compartments that would perform their necessary functions, but would not cause the whole spacecraft to die when one or two experiments or subsystem components malfunctioned.

The spacecraft subsystems were designed to be compatible with the Delta and Titan rockets, as well as the Shuttle. In this configuration the spacecraft can support a multitude of scientific and Earth applications missions without the necessity for costly redesign and development. Also, because the design can be fitted, in different configurations, to the Delta, Titan and Shuttle, the payloads can be placed in orbit in the late 1970s and serviced or retrieved by the Shuttle in the early 1980s.

In its operational mode on a Shuttle service or refurbishment mission, the Remote Manipulator System (RMS) of the Shuttle would first capture the LCMS by using its long arms (15 meters or 50 feet) to reach out and pick the spacecraft from orbit. It would then move it into the Shuttle bay and place it on the docking platform, hold it securely or rotate it 360 degrees as needed.

Next the onboard Module Exchange Mechanism (MEM) starts servicing the spacecraft. The MEM consists of electronically-controlled mechanism that can be raised and lowered from the onboard Module Magazine area. The mechanism can take a new module out of the storage magazine, pull a malfunctioning one out of the spacecraft, and replace it with the new one. The malfunctioning subsystem is then

stored in the magazine which can then be taken back to Earth for repairs.

Shuttle astronauts observe and control the whole operation from the foreward cabin directly and by closed circuit television. They operate the mechanisms via a simple control console which has two television screens for close observation of the work area. The TV cameras are located in the cargo bay of the Shuttle and on the manipulator arm.

The LCMS engineering model has been moved from Goddard to Rockwell's facility at Seal Beach, CA, for testing and early next year will be integrated with the full-scale Shuttle model at Downy, CA, for verification tests.

JPL WRITER HONORED

William P. Buttler, technical writer for the Jet Propulsion Laboratory, has been named 1974 Distinguished Newspaper Adviser for two-year colleges.

The award, offered for "those persons who have provided the leadership in the nation that demonstrates superior professional competence," was made by the National Council of College Publications Advisers. It was conferred on Buttler at its recent national convention in Hollywood, FL.

A member of the Pasadena City College for 27 years, Buttler has been affiliated with JPL as a summer employee and a teacher of technical writing since 1959.

MSFC FACILITIES MODIFIED

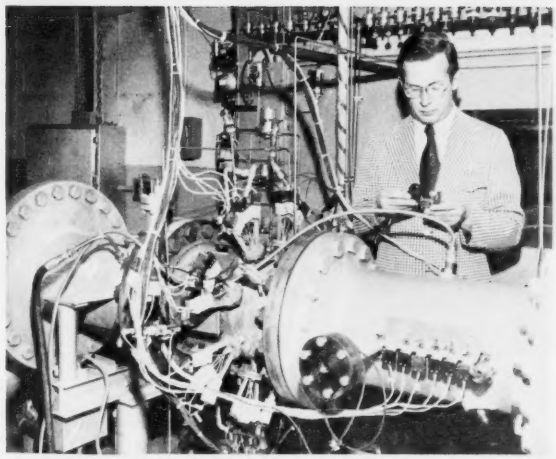
A $3,831,000 contract has been awarded Algernon-Blair Industrial Contractors, Inc., Atlanta, GA, for modifications to existing facilities at the Marshall Space Flight Center to be used in structural testing of the Space Shuttle External Tank.

The contract calls for modifications to the S-IC test stand that was formerly used by MSFC to test Saturn launch vehicles for the Apollo program. When completed, the facility will provide the capability for structurally testing the liquid hydrogen tank portion of the Shuttle External Tank.

The 18-month contract calls for completion of the modifications by May 1, 1976.

FELLOWSHIP AWARDEE

Ann Bradley, a Personnel Management Specialist at Headquarters, has been selected by NASA under its Executive Development Program to receive one of 12 fellowships for graduate education. She has been accepted as a Princeton Fellow in Public Affairs in the Woodrow Wilson School at Princeton University for the 1974–1975 academic year.



TESTING JET FUELS—Engineer Robert Ehlers examines a combustor nozzle used in tests of alternative jet engine fuels at Lewis Research Center. Blends of jet fuels are tested in the JT8D jet engine combustor (center) to determine combustion and emission characteristics.

FUEL TECHNOLOGY STUDY

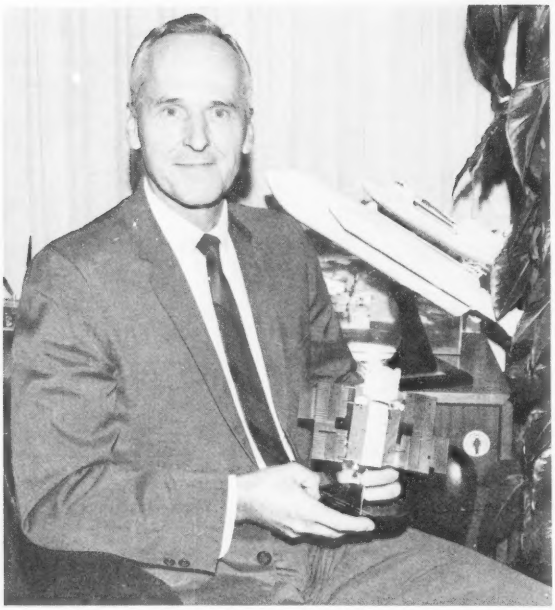
In an effort to make U.S. civil aviation less dependent on conventional petroleum supplies, a program is underway at Lewis Research Center to investigate the effects of fuels derived from oil shale and coal on aircraft engines and fuel systems.

The studies involved in the program will also determine if jet engines and fuel systems can operate satisfactorily on hydrocarbon fuels refined to less stringent specifications. This part of the program is intended to study jet engine fuel system tolerance for fuels possessing a wide variety of characteristics.

Aircraft presently account for nearly eight percent of the total petroleum consumption of the U.S. Demand for jet fuels is increasing with the growth of air transportation. Alternate fuels may help to meet these growing needs. Oil shale and coal, the principal sources of such substitute hydrocarbon fuels, are abundant.

Once the results of combustor tests are known and alternate fuels can be produced by industry in large quantities, Lewis plans to conduct tests of compounds in full-scale engines. These tests are scheduled to begin in the late 1970s.

"Large-scale production of jet fuels from oil shale or coal may be as much as 10 years away," says Richard A. Rudey, Chief of the Pollution and Combustion Branch at LeRC. "Nevertheless, it may take that long to evolve the technology that fulfills the safety, environmental, reliability, and economic requirements of commercial aircraft."



BANQUET SPEAKER—Dr. Robert H. Gray of the KSC Shuttle Projects Office.

AEROSPACE TECHNOLOGY EFFECTS CITED BY GRAY

KSC Official Is Principal Speaker at Recent Symposium Banquet

Aerospace technology has made the world seem smaller and its people interdependent, Dr. Robert H. Gray, Manager of the KSC Shuttle Projects Office, told attendees at the Ninth Aerospace Mechanisms Symposium banquet held at Kennedy Space Center recently.

The symposium was sponsored jointly by NASA, the California Institute of Technology and Lockheed Missiles and Space Company, Inc.

"Scientific discovery and technological application progress together, reinforcing each other," Dr. Gray continued. "The space program spurred computer development, and computers are now widely used by both scientists and businessmen.

"The Space Shuttle will be the workhorse of the space program in the 1980s, providing an economical means of putting heavy payloads into low Earth orbit. Spacecraft designed for Shuttle launch will be much less expensive than present ones, and can be recovered and repaired if necessary.

"Other nations recognize the importance of the Shuttle system and are joining us in its development."

The two-day symposium featured papers on the application of aerospace mechanisms for solutions to present-day problems, aircraft and space vehicle mechanism development and operation, comparison of design principles and the areas of reliability, weight, dimensions and interaction with space and other environments, and possible applications of existing conventional mechanisms to flight.

Morning sessions on the opening day were chaired by K.A. Faymon, Lewis Research Center, and E. E. Sechler, California Institute of Technology. Afternoon sessions were presided over by A. C. Bond, Johnson Space Center, and F. T. Martin, Goddard Space Flight Center.

Morning sessions on the second day were under the chairmanship of K.C. Curry, Jet Propulsion Laboratory, and Angelo Giovannetti, Ames Research Center.

The afternoon session of the second day, chaired by D. D. Buchanan, Kennedy Space Center, featured a field trip to Complex 39. Following presentations in the Launch Control Center, symposium participants visited the Vehicle Assembly Building and Pad B, and later viewed the giant transporters that move Apollo/Saturn space vehicles from the assembly building to the launch site.

Attending the symposium, in addition to government, educational and industry delegates, were Florida educators and college engineering-science students.

WINDMILL CONTRACTS LET

NASA and the National Science Foundation (NSF) have announced the award of contracts to two industrial firms for preliminary design of large wind energy systems for generating electricity. They are the General Electric Co., Space Division, Valley Forge, PA, and the Kaman Aerospace Corp., Bloomfield, CT.

Each contractor will examine modern versions of windmills at sizes from 100 kilowatts for use by small communities or farm cooperatives to three megawatts (3,000 kilowatts, or three million watts) for possible connection into the power networks of large utility companies.

The projects are expected to provide the most intensive study of very large wind energy systems conducted in this country in more than 20 years. The design studies, scheduled for nine months, will provide a basis for decision whether to proceed with construction of experimental systems.

A three megawatt windmill would be larger than the largest windmill known to have been constructed in the past. Its rotor vanes would be ap-

LOW COST CORNER
"NEED A NEW ONE' (AND SHORT OF CASH?) YOUR EQUIPMENT VISIBILITY SYSTEM COORDINATOR MAY BE ABLE TO HELP. THINK EVS!"

proximately 200 feet in diameter, and each windmill would produce enough electricity to supply 100 to 200 homes.

A 100-kilowatt system with vanes more than 120 feet in diameter is already under design and construction by Lewis Research Center, with NSF support, and will be erected at that Center's Plum Brook Test Area near Sandusky, OH. It is expected to be in experimental operation by July, 1975.

Group Captain Peter Wittingham of the Royal Air Force Institute of Aviation Medicine at Farnborough, England, has joined the Johnson Space Center Life Science Directorate. He will spend one year on loan from the RAF as consultant to the JSC Director of Life Sciences in planning research in support of Space Shuttle and other advanced programs.

SPACE STAMPS POPULAR

The U.S. Postal Service reports that two stamp collecting kits on the subject of space, among six new ones now offered for sale at post offices throughout the U.S., are the most popular collectors' items in recent years.

The space kits consist of a revised edition and a second edition. Each includes 40 or more worldwide stamps, a small album, mounting hinges, insert sheets for additional stamps, and a 32-page booklet entitled "The ABC's of Stamp Collecting."

Other topics represented in the six kits are sports, birds and butterflies, animal kingdom, and art masterworks. Priced at $2 each, they can be obtained from post offices or from the Philatelic Sales Division, U.S. Postal Service, Washington, D.C. 20036.

ENERGY VISITORS AT MSFC

Officials of the Federal Energy Administration Regional Office in Atlanta, GA, including Kenneth L. Dupuy, Regional Administrator, visited the Marshall Space Flight Center Nov. 20 for briefings on the capabilities and facilities of the Center in the area of energy research and development.

Topics included MSFC's role in implementing the recently-enacted Solar Energy Heating and Cooling Act and current energy studies in research and development of solar-thermal electric power, space-based power systems, and hydrogen energy systems.

In addition to the briefings, Dupuy and his party visited MSFC's operating solar house, which is being heated and cooled by solar energy, and inspected solar energy collection panels, fuel cells and flat conductor cable being developed at the Center.

FIRMS GET LST ROLES

Three firms were selected in November for negotiation of parallel contracts for preliminary design and program definition studies for the Support Systems Module (SSM), a major element of the Large Space Telescope (LST). They were: Boeing Aerospace Corp., Seattle, WA; Lockheed Missiles and Space Co., Inc., Sunnyvale, CA; and Martin-Marietta Corp., Denver, CO.

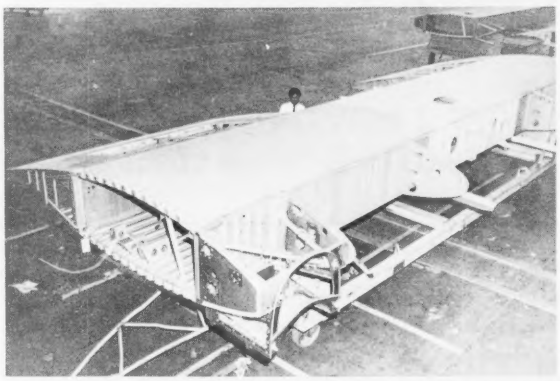
Each contract will be funded at approximately $400,000 for fiscal year 1975.

The LST, planned as a payload for the Space Shuttle, is being designed as an optical telescope observatory to be used in Earth orbit unhindered by atmospheric distortion. The SSM will be attached to the structure housing the telescope and will provide electrical power, data storage, communications and automated attitude sensing, pointing and control.

The unit also will contain some of the elements needed for orbital servicing and retrieval of the telescope by the Space Shuttle. The LST will be repaired or refurbished periodically and returned to service, thereby providing long-term operational use.

In addition to the SSM, the two other principal elements of the LST will be the Optical Telescope Assembly (OTA) and the Scientific Instruments (SI).

The Goddard Space Flight Center is responsible for the design and definition of the SI, while Marshall Space Flight Center manages the overall program, as well as development of the OTA and SSM. The total project is under the direction of the Office of Space Science at Headquarters.



WEIGHT-SAVING WING—On display in this photograph is one of the center wing box structures employing a boron-epoxy composite as a reinforcer that is now being flight-evaluated under a joint NASA/USAF program. The composite reinforcement allows use of a thinner gauge metal structure, resulting in a 500-pound weight saving that can be applied to increased payload or fuel.

PICKERING RECEIVES AWARD

Dr. William H. Pickering, Director of the Jet Propulsion Laboratory, was presented the Guglielmo Marconi Award for his contributions to communications technology at a recent ceremony at Pontecchio, Italy.

Dr. W.H. Pickering

Presented in commemoration of the 100th anniversary of the birth of the Italian physicist who invented short-wave wireless, the award included a 5-million lira ($7,800) prize.

Dr. Pickering, who has been Director of JPL since 1954, received the honor for his leadership of the Laboratory's pioneering efforts in space exploration and its development of telemetry and telecommunications systems. JPL has managed the Ranger, Surveyor and Mariner lunar and planetary projects for NASA and operates NASA's world-wide Deep Space Network.

Pontecchio is the site of the original Marconi laboratory and is near Bologna, Marconi's birthplace.

SMALL BUSINESS CONTRACTS RISE

NASA contract awards to small business during FY 74 totaled $181,247,000—or 8.6 percent of all contracts. This was the highest percentage awarded in any one year since 1962.

Ken Kier, NASA's Small Business Advisor, attributes the increase to an agency-wide effort for greater small business participation in NASA procurement programs.

By appropriation category, small business contracts included: research and development, $117,384,000, or 6.1 percent; research and program management, $35,359,000, or 32.2 percent; and construction of facilities, $28,490,000, or 39.1 percent.

During FY 74, NASA contract awards to both large and small business totaled $2,118,627,000.

NASA has selected Boeing Aerospace Co., Seattle, WA; Lockheed Missiles and Space Co., Inc., Sunnyvale, CA; and Martin-Marietta Corp., Denver, CO, for negotiations of parallel contracts for preliminary design and program definition studies for the Support Systems Module, a major element of the Large Space Telescope.

TOKEN OF APPRECIATION—Oceola Hall (left), Nasa Federal Women's Program Coordinator, and Jo Marie DiMaggio, Headquarters Federal Women's Program Coordinator, present a certificate of appreciation to Col. Lawrence W. Vogel, Director of Headquarters Administration, for his active support of the Federal Women's Program Week.

WOMEN'S WEEK HELD

The first Federal Women's Program Week, focusing around a theme of "A Woman's Place Is *** Everywhere!", was held recently at NASA Headquarters.

Opening with a song, "I Am a Woman," sung by Annette Spears, and with a talk by Caroline Bird, author of books and magazine articles on women, the week was devoted to activities open to participation by all Headquarters employees, male and female. Included were workshops, films, panels, a skit and exhibits.

Objectives of the program were: (1) the equality of women and men in every sphere, with particular emphasis on women adequately competing and advancing in the working world, and (2) women and men being freed from stereotyped roles and images.

Workshops were held on the subjects of "Leadership Training," "Certified Professional Secretaries and National Secretaries Association," "How to Handle an Interview," "Toastmaster's Effective Speaking," "Assertiveness Training for Women," "Health: (1) Nutrition (2) Stress Lab," "How to Defend Yourself," "I'm OK–You're OK," and "How to Prepare an Effective Standard Form 171."

Two panel discussions were held. They were on the subjects of "Successful NASA Women" and "Women Today."

Speaking at one of the sessions, Edwin C. Kilgore, Deputy Associate Administrator for Center Operations, said: "It would be my hope that next year, when we next observe NASA Federal Women's Week, that we shall be able to point with pride to the accomplishments that have been made. When I speak of accomplishments, I don't merely refer to how many females have been hired, or how many have been able to participate in our upward mobility programs. I'm speaking of the progress that we all have made in our attitudinal change. The kind of change that will hasten the year when we can, as people, mark the observance of our first Federal Peoples Day, and that it will coincide with the demise of the need for a special occasion for the recognition of women."

The Federal Women's Program Week was initiated by NASA's Women's Program Coordinator, Oceola Hall, and was planned and coordinated by the NASA Federal Women's Program Committee, chaired by Jo Marie DiMaggio, Headquarters Federal Women's Program Coordinator.

HOMES TO GET SPACE WIRING

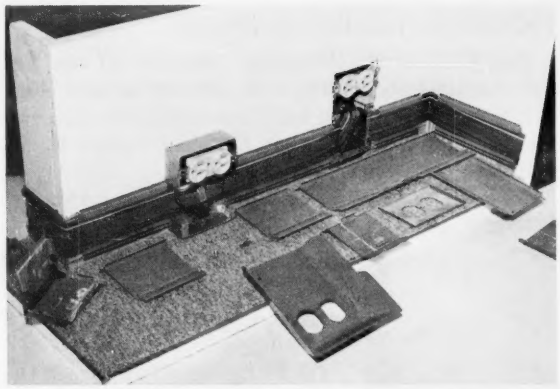
Flat conductor electrical cable originally developed by NASA for spacecraft wiring will be installed this month for the first time as electrical wiring in private residences.

The Marshall Space Flight Center and the New York State Urban Development Corp. (UDC) have been involved over the last few years in a joint project to transfer technology used in the aerospace development of flat conductor cables to home-wiring applications.

MSFC efforts in this project have resulted in a low profile conductor cable that will be employed in a surface mounted snap-on baseboard electrical system in six UDC-built apartments in Yonkers, NY.

When the installation of the cables is completed and the apartments have been rented, MSFC will begin a year-long evaluation of the system's performance in conjunction with UDC and Underwriters Laboratory.

As the cost of building materials and labor rises, various new concepts of construction are continually being considered. These concepts and the rehabilitation of old dwellings have indicated a need for a new type of home-wiring system.



FLAT WIRING—A flat conductor electrical snap-on baseboard system similar to the type to be installed in Yonkers, NY, homes.

Flat conductor cable has several advantages over round wiring. It is easily installed and maintained. In addition, it can be attached to the outside walls under wallpaper or even paint, or it can be laid on floors under rugs or behind snap-on plastic baseboards.

GORDON HARRIS TO RETIRE

Gordon L. Harris , Kennedy Space Center's first public affairs chief, will retire Dec. 31, 1974. He was selected for the position in 1963 by Dr. Kurt H. Debus, who was then Center Director.

Harris joined the nation's missile program at Huntsville, AL, with the Army Ballistic Missile Agency in October, 1956. In 1960, he was transferred to the Pentagon as Assistant Chief of Army Information. He subsequently joined the Defense Supply Agency, with which he was serving when selected by Dr. Debus.

A graduate of Columbia College, New York City, he published a newspaper in Dover, NJ, for 25 years before going to Huntsville. He also served in the Counter Intelligence Corps in the Western Pacific during World War II, and was Assistant Inspector General in the Eighth Army in Korea.

Savannah State College of Savannah, GA, will conduct ecological studies of estuarine waters near the nation's Spaceport under a $34,375 grant from Kennedy Space Center.

SMITH NAMED MSFC DEPUTY

Richard G. Smith, Acting Director of Science and Engineering at the Marshall Space Flight Center, has been appointed Deputy Director of that Center.

Richard G. Smith

He has been with MSFC since 1960 when the Development Operations Division of the U.S. Army Ballistic Missile Agency became the nucleus for the establishment of the Center. He held various positions of increasing responsibility in the Science and Engineering Directorate until 1970, when he was named Manager of the Saturn program. In 1973, he was appointed Director of the Science and Engineering Directorate.

Smith, 45, was graduated from Auburn University in 1951 with a Bachelor's degree in electrical engineering. In 1969, he received the NASA Medal for Exceptional Service for his role in the Apollo lunar landing program. Last year, he was honored with the NASA Medal for Distinguished Service.

For the present, he will remain as Acting Director of Science and Engineering while taking on the added responsibilities of Deputy Director of MSFC.

SPECIAL SKYLAB AWARDS GIVEN AT MSFC CEREMONY

Team Members and Industry, Science and University Representatives are Honored

A special Skylab awards ceremony honoring Skylab team members and individuals from industry, the scientific and university communities and other government agencies was held at the Marshall Space Flight Center Nov. 21.

Dr. James C. Fletcher, NASA Administrator, presented 39 group and individual awards for outstanding exploits in the fields of science, engineering and operations during the history-making Skylab program.

Group Achievement Awards for program management were presented to the Skylab Program Office at MSFC, Kennedy Space Center, Johnson Space Center and NASA Headquarters.

MSFC Skylab groups receiving the Group Achievement Award were the Solar Science Experiment Team, Space Sciences Experiment Team, Space Sciences Technology Team, and Transportation Team.

Group Achievement Awards were also made to the Navy Underwater Support Team assigned to MSFC by the U.S. Navy and to personnel from Headquarters and the Centers for Skylab Educational Activities.

Dr. Robert A. Parker, NASA astronaut and Skylab Program scientist at JSC, received an Outstanding Leadership Medal.

Dr. Fletcher presented 28 individual Exceptional Scientific Achievement Medals to principal investigators for Skylab experiments and to scientific investigators for Comet Kohoutek.

Recipients from industry and universities of the individual awards follow:

Dr. James D. Frost, Jr., Principal Investigator (PI), MI33, Baylor School of Medicine, Houston, TX; Dr. Ashton Graybiel, PI, MI31, Naval Aerospace Medical Research Laboratories, Pensacola, FL; Dr. Harry C. Gatos, PI, and Dr. August F. Witt, Associate PI, M562, Massachusetts Institute of Technology; Dr. Curtis L. Hemenway, PI, S149, Dudley Observatory, Albany, NY; Dr. Robert M. MacQueen, IPI, S052, University of Colorado; Thornton Page, Kohoutek Investigator, U.S. Naval Research Laboratory, Houston, TX.

Dr. Edmond M. Reeves, PI, SO82B, Harvard College Observatory, Cambridge, MA; Dr. Richard Tousey, PI, SO20 and S082A, U.S. Naval Research Laboratory, Washington, DC; Dr. Giuseppi A. Vaiana, PI, S054, Smithsonian Institution; Dr. Hans U. Walter, PI, M560, University of Alabama at Huntsville; Dr. Jerry L Weinberg, PI, S073, Dudley Observatory; Dr. Harry Wiedemeir, PI, M556, Rensselaer Polytechnic Institute, Troy, NY; Dr. G. Donald Whedon, PI, National Institute of Health, Bethesda, Md, and Dr. John T. Yue, PI, M559, Texas Instruments, Dallas.

The Exceptional Scientific Achievement Medal was also given ot the following individuals from NASA Centers:

Dr. Karl G. Henize, Scientist-astronaut and PI, S019, JSC; Dr. George W. Hoffler and Dr. Jerry L. Homick, Medical Investigators, JSC; Dr. Carolyn L. Huntoon, PI, M073, JSC; Dr. Robert L. Johnson, PI, M092, JSC; Stephen L. Kinzey, PI, M115 and M479, JSC; Joseph T. McGoogan, PI, S193, Wallops Station; Edward L. Michel, PI, M171, JSC; James E. Milligan, PI, S056, Goddard Space Flight Center; Dr. John A. Rummel, PI, M171, JSC; John B. Sevier, Jr., Skylab Deputy Program Scientist, JSC; William C. Snoddy, Project Scientist for Comet Kohoutek Observational Program, MSFC; and Dr. William E. Thornton, Jr., PI, M074 and M172, JSC.

NASA WRITER INTERVIEWS FORDS

The lead article in the November issue of FAMILY HEALTH, a magazine of national circulation, is entitled "The Fords: Health Is a Family Affair." It was written by Mrs. Lillian Levy, senior science writer for NASA.

The article discusses the First Family's health habits and their belief in preventive medicine. These may have helped save the life of the First Lady since it was during her regular supplementary

gynecological examination that the discovery of the cancer in her right breast was made.

During Mrs. Levy's interview before the First Lady entered Bethesda Naval Hospital for surgery, Mrs. Ford discussed the family battle against weight and their eating habits and food preferences, as well as her views on parental attitude toward children who may be taking drugs. The President also provided his views on this subject.

SKYLAB REPORTS—James W. Clark of the Marshall Space Flight Center's Skylab Program Office stands beside the set of books compiled in connection with the technical report on the Skylab mission, now complete. Copies can be obtained from the National Technical Information Service, Springfield, VA 22151.

SKYLAB DATA PROCESSED

The enormous task of computer processing the scientific data gathered during the Skylab mission, which ended Feb. 8, has been virtually completed.

Computers in the Marshall Space Flight Center's computer complex and at the NASA-Slidell Computer Facility in Slidell, LA, have been carrying a heavy workload since the end of the Skylab mission and, as a result, the October target date was substantially met.

Skylab data processing will continue for several months at a greatly reduced rate, however. It will include some re-runs of data to clear up any processing anomalies, gaps in the data, and to respond to new Principal Investigator requirements.

Analysis of all the data by the investigators, however, will take years to complete.

CERNAN WRITES ARTICLE

"Surveying Planet Earth" is the title of the lead article in the December issue of OUTDOOR INDIANA, a magazine published by the Indiana Department of Natural Resources, Indianapolis, IN. It was written by Navy Captain Eugene A. Cernan, a Purdue University graduate, pilot of Gemini 9, lunar module pilot of Apollo 10 and commander of the Apollo 14 lunar landing mission.

In the article, Cernan states:

"Earth, the spaceship on which we live, had always been taken for granted as a permanent and indestructible home for Man. The findings of Apollo, as we looked back from the Moon and saw how tiny Earth is in the blackness of space, suggest that we should not be so sure. It is vital that Man finally has seen his home from the depths of space, and has understood how frail an abode it really is.***

"Every object on Earth, living or inanimate, absorbs, transmits or reflects visible and invisible lightwaves from the Sun in a distinctive manner. Photographed in four different spectral bands by the ERTS cameras, an object beneath the satellite can be identified by its radiation pattern, or 'spectral signature.'***

"Space is an infinite laboratory into which we are bringing instruments, the equipment, and the skilled experimenters to unravel the mysteries we can only guess at here on Earth's surface. So we look forward to future longer-duration space stations."

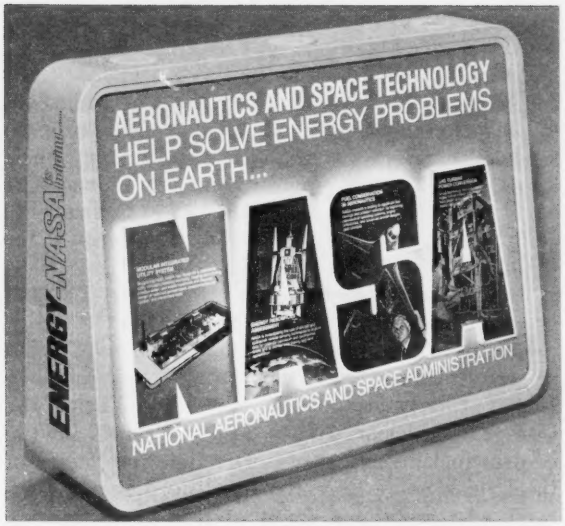
SATURN STANDS MODIFIED

Test stands used for testing Saturn stages in the Apollo program at the National Space Technology Laboratories (NSTL) in Mississippi are being modified to make up the Shuttle's Orbiter Propulsion System Test Facility.

This new work, to be completed by Aug. 30, 1976, is being done by Industrial Contractors, Inc., of Idaho Falls, Idaho, under a $7,429,069 contract.

The project is one in a series of contracts awarded for NASA by the U.S. Army Corps of Engineers and is the third for Industrial Contractors, Inc., at NSTL.

Modification work previously undertaken at NSTL has included modification of Saturn test stands for Space Shuttle main engine testing and rehabilitation of cryogenic systems and pressure reducing stations.



DEPICTING THE NASA STORY—Here are photos of the two latest displays to be circulated among airport terminals in Boston, Washington, Chicago, St. Louis, Minneapolis, Indianapolis, Detroit, Omaha, Sioux Falls, Philadelphia and Milwaukee. NASA rents showcase space as one means of telling thousands of people about its programs. Similar displays on the subjects of Space Shuttle, NASA and Your Health, ERTS, NASA and Your Safety, Aeronautics, Energy, and ASTP also will be included.

JAFFE HEADS I.A.F.

Leonard Jaffe, NASA's Deputy Associate Administrator for Applications, was elected president of the International Astronautical Federation (I.A.F.) at its recent 25th International Astronautical Congress, held in Amsterdam, The Netherlands.

Leonard Jaffe

The I.A.F. is a non-governmental association of 55 national aerospace associations in 36 countries. Its aims are to foster the development of astronautics for peaceful purposes, to encourage the widespread dissemination of technical information, to stimulate public interest in space flight through the major media of mass communication, to encourage astronautical research, to convoke congresses and scientific meetings, and to cooperate with other organizations in work related to all aspects of astronautical and the peaceful uses of outer space.

Jaffe began his career with NASA when he joined its predecessor, the National Advisory Committee for Aeronautics (NACA) in 1948 as an aeronautical research scientist at the Lewis Flight Propulsion Laboratory (now Lewis Research Center) in Cleveland.

After transferring to NASA Headquarters, he served as Director of Space Applications Programs in the Office of Space Science and Applications and then as Deputy Associate Administrator for Space Science and Applications (Applications) before being appointed to his present position when the Office of Applications was established in 1972.

He has been the principal architect of and spokesman for NASA's communications satellite program since it was established in 1959 and is the author of many publications, including the book, "Communications in Space," published in 1966. He was awarded the NASA Exceptional Service Medal in 1964, the Arthur S. Flemming Award for Scientific and Technical Achievement in 1965, and the IEEE Award in International Communications in 1967.

RADIO-TELEVISION
(Released Nationally)

DECEMBER

TELEVISION–A color film in the *Aeronautics and Space Report* monthly series, "Search and Rescue by Satellite."

RADIO–Five weekly Space Story programs have been released: "Pioneer Jupiter Science," (ARC/Wolfe); "Satellite Search-Rescue," (G.E./Roy Anderson); "Earthquake Prediction," (JPL/MacDoran); "New Fuels Technology," (LeRC/Rudey); and "Goodby Great Divide," (STD/Gordon Law). One monthly NASA Special Report, *NASA Special Report*, "1974—The Year In Review."

VORTEX FLIGHT STUDIES—Using a 747 jet transport, NASA and the Federal Aviation Agency are conducting tests at the Flight Research Center in California on wing tip vortices—the normally invisible flows of turbulent air streaming in a circular or funnel-shaped flow from the wing tips of aircraft—to determine the effects, if any, on other aircraft operating in the terminal area.

HYDROGEN STUDY CONTRACT LET

A $169,000 contract for the study of hydrogen as a possible general energy source of the future has been awarded the Institute of Gas Technology (IGT), Chicago, Il, by the Marshall Space Flight Center.

The 10-month study will evaluate methods of producing large quantities of hydrogen and select a few of the most promising for follow-on studies. It will also identify present and future uses of hydrogen in the industrial and residential sectors.

The IGT study will include estimates of resources required and costs for developing technology. It also will contain recommendations for a series of follow-on studies and development programs that could lead to the use of hydrogen as a major energy source.

MSFC is managing the study for NASA's Office of Energy Programs.

BALLOON FLIGHTS AID HEAO

A series of balloon flights for the development of instruments for use aboard satellites in space is being conducted for groups of High Energy Astronomy Observatory (HEAO) scientists in conjunction with the Marshall Space Flight Center. The National Center for Atmospheric Research launches and tracks the balloons.

The Marshall Center is managing the HEAO program for NASA's Office of Space Sciences. In this program, MSFC is integrating instruments or experiments developed under Center contracts by principal investigators.

The experiments are to be flown on HEAO missions in Earth orbit at an altitude of about 400 kilometers (250 miles) to study some of the most intriguing mysteries of the universe—pulsars, black holes, neutron stars, quasars and supernovae. The balloons carry development models of instruments with telemetry systems and data recorders for evaluating instrument functions.

Flights have been made from Palestine, TX, and Sioux City, IA.

The principal investigator for a French-Danish experiment designed to study the isotopic composition of primary cosmic rays is Dr. Lydie Koch of the Center for Nuclear Studies, Saclay, France, and the co-principal investigator is Dr. Bernard Peters of the Danish Space Research Institute, Lyngby, Denmark. An additional flight of this experiment is scheduled for May, 1975.

The principal investigators for a Hard X-Ray and Low Energy Gamma-Ray experiment are Dr. Laurence Peterson of the University of California at San Diego and Dr. Walter Lewin of the Massachusetts Institute of Technology.

The pulsars, black holes, neutron stars, quasars and supernovae to be examined by the HEAO satellites are phenomena discovered fairly recently and known to be sources of extremely high energy.

HORSE SHOW WINNER—Karl P. Mautner of NASA's Office of International Affairs, is photographed astride the horse with which he won first prize in the Diplomatic Officers Event at the International Horse Show held in Washington recently and attended by President and Mrs. Ford. His experience as a horseman includes participation in international shows in Switzerland and in Germany during his years as a foreign service officer.

—Photo by Bob Foster of Pinellas Park, FL.

SKYLAB STUDENT EXPERIMENTERS—Three of the Skylab student investigators presented scientific papers at Huntsville, AL, recently during a conference sponsored jointly by the American Institute of Aeronautics and Astronautics and the American Geophysical Union. Shown with Henry Floyd (right), Marshall Space Flight Center's Manager of the Skylab Student Program, are (left to right) Terry Quist, San Antonio, TX, Judith Miles, Lexington, MA, and Todd Meister, Jackson Heights, NY.

HEADQUARTERS PRESS RELEASES

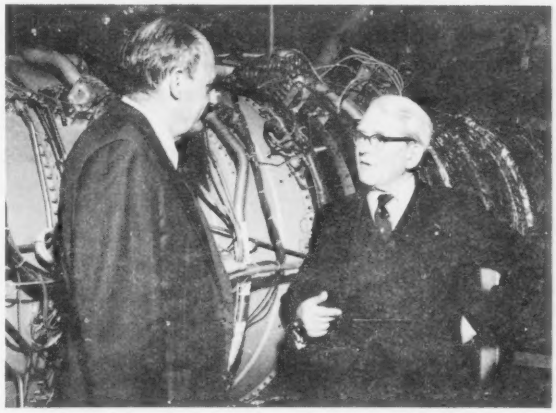
(Issued by the Public Information Division, Code FP, Headquarters, Washington, DC 20546. These releases are available only to members of the news media.)

74-278 Space Pictures May Help Measure Rainfall
74-279 Initial Space Shuttle Flights to Land in California
74-280 Amateur Radio Satellite Will "Talk" to Classroom
74-281 Correspondents Should Make ASTP Hotel Reservations
74-282 Pioneer 11 Enters the Record Book
74-283 Cousteau to Help in U.S.-Sponsored Marine Research
74-284 Soyut Flight Controllers at JSC for ASTP Training
74-285 NASA to Hold 16th Annual Awards Ceremony
74-286 NASA Patent Licensing Conference Scheduled
74-287 First Flat Electrical Cable Being Put in Private Housing
74-288 Short Course Offered in Heat Pipe Technology
74-289 Iran to Build Earth Resources Ground Station
74-290 NASA Tests Lightweight Material in Air Craft Wings
74-291 NASA Schedules Women's Week
74-292 Pioneer 11 Jupiter Encounter Press Kit
74-293 NASA Small Business Contracts Increase
74-294 Large Area Crop Inventory Experiment
74-295 Speech by Capt. Chester M. Lee
74-296 Pioneer News Center at Ames Opens
74-297 Space Fillers
74-298 NASA Studies New Fuels Technology
74-299 Solid State Data Recorder Has No Moving Parts
74-300 Pioneer 11 Scientist Will Brief Press on Nov. 19
74-302 NASA, Science Foundation Sign Agreement on Energy Studies
74-303 Skynet II-B Press Kit
74-304 ASTP Experiment Promotes Understanding of Energy Generation
74-305 Intelsat IV Press Kit
74-306 Note to Editors
74-307 Dr. Low Speech Excerpts
74-308 NASA Selects Three Firms for LST Competition
74-309 NASA Official to Speak at Arecibo Dedication
74-310 NASA Launch Site Takes on International Flavor
74-312 NASA Awards Contracts for Design of Windmill Generator
74-313 ALSEP 12 Five Years Old and Still Going Strong

NASA IN FOOD PICTURE

The space agency's role in surveying the world's food crops was mentioned by Secretary of State Kissinger in his address before the United Nations World Food Conference held recently in Rome, Italy. The reference to NASA was included in the following paragraph:

"We also plan a number of new projects next year. Our space, agriculture and weather agencies will test advanced satellite techniques for surveying and forecasting important food crops. We will begin in North America and then broaden the project to other parts of the world. To supplement the WMO study on climate, we have begun our own analysis of the relationship between climatic patterns and crop yields over a statistically significant period. This is a promising and potentially vital contribution to rational planning of global production."



INVENTOR VISITS LeRC—Sir Frank Whittle (right), inventor of the gas turbine jet engine, was a recent visitor at the Lewis Research Center. He is shown here with Jack B. Esgar, Chief of LeRC's Airbreathing Engines Division, in front of a modern jet engine used to demonstrate the feasibility of making present day aircraft quieter through engine modifications. The British pioneer's engine was the first to be tested in an altitude chamber at Lewis in 1943.

LUNAR SAMPLE EXHIBITS

The following is a schedule of lunar sample exhibits from Dec. 15, 1974, to Jan. 15, 1975:

CALIFORNIA—Open House Science Exhibit, Los Medanos College, Pittsburg, Jan. 13–17; Dedication-Space Science Center, Foothill College, Los Altos, Jan. 10–12.

NORTH CAROLINA—Community Impact, Morehead Planetarium, Chapel Hill, Jan. 13–26.

TEXAS—Houston Museum of Natural Science/History, End of Caroline at Hermann Park, Houston, Dec. 15–Jan. 15.

WASHINGTON, DC—NASA Headquarters, Dec. 9–20.

Permanent Displays

ALABAMA—Alabama Space and Rocket Center, Marshall Space Flight Center, Huntsville.

FLORIDA—Visitor Information Center, Kennedy Space Center.

KANSAS—Eisenhower Library, 200 SE 4th Street, Abilene.

NEW YORK—United Nations Building, New York City.

OHIO—U.S.A.F. Museum, Wright Patterson Air Force Base.

TEXAS—Johnson Library, University of Texas, Austin; Visitor Information Center, Johnson Space Center, Houston.

VIRGINIA—Visitor Information Center, Langley Research Center, Hampton.

WASHINGTON, DC—National Geographic Museum; Smithsonian Institution, National Air and Space Museum, 1000 Jefferson Drive.

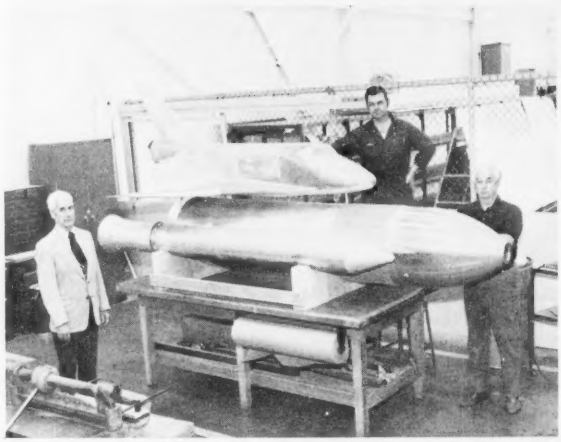
MICHOUD SUPPORT CHOSEN

Boeing Services Internation (BSI) has been selected by NASA for negotiations leading to the award of a contract for the operation of the Michoud Assembly Facility at New Orleans, LA.

The contractor's proposed cost for the two-year cost plus award fee contract, plus an option for one additional year, totals approximately $12.5 million.

The scope of the work to be performed under this contract includes plant engineering, maintenance and operation facilities, institutional support, and other support services. BSI plans to subcontract food and some other services.

The work force will be acquired from local resources, including former Boeing Michoud Saturn V employees, incumbent contractor employees currently performing facility work at Michoud, and other local applicants.



SHUTTLE TEST MODES—A 1/15 scale model of the Space Shuttle, built at the Marshall Space Flight Center, will be used there to determine the range safety radi-frequency antenna pattern coverage and to optimize antenna placement on the Solid Rocket Booster. Pictured with the model, left to right, are Thomas E. Bowling, Richard C. Shipp and Edward F. Powell, all of MSFC.

NASA TECH BRIEFS

(The Technology Utilization Office; NASA Headquarters)

(The following is a listing of published NASA Tech Briefs. Inquiries concerning them should be directed to the TU Office at the originating NASA Center.)

Innovator(s)	*Title*	*Number*	*Center*
Hugh B. Bauer and Henry D. Obler, GSFC	Automatic Air Flow Control in Air Conditioning Ducts	B72–10490	GSFC
K.D. Castle, JSC, and M. Weinberger, C. Russell, Jr., K.P. Joncas, S. Birnbach and M. Lambert, III, Avco Corp.	Dynamic Power Load Simulator	B73–10305	JSC
A.R. Sinclair, S.J. Katzberg and E.E. Burcher, LaRC	Automatic Focus Control for Facsimile Camera	B73–10361	LaRC
John C. Sturman, LeRC	Low Cost Instrumentation Amplifier	B74–10015	LeRC
Harole E. Sliney, LeRC	Plasma-Sprayed Metal-Glass Flouride Coatings for Lubrication to 1170 K (1650°F)	B74–10016	LeRC
H.A. Will and J.A. Powell, LeRC	Improved Epitaxial Process for Fabricating Silicon Carbide Semiconductor Devices	B74–10017	LeRC
J.M. Kazaroff and R.A. Duscha, LeRC, and L.C. McCandless, General Technologies Corp.	High Strength, Wire-Reinforced Electroformed Structures	B74–10018	LeRC

NASA TECH BRIEFS—Cont.

D.R. Buchele and D.J. Lesco, LeRC	Rotating Turbine Blade Pyrometer Switch	B74-10068	LeRC
James C. Howard, ARC	Suppression of Bending Motion in Elastic Bodies	B74-10070	ARC
John Dimeff, ARC	Modulated Hydrogen-Ion Flame Detector—A Concept	B74-10071	ARC
Dah Yu Cheng, ARC	Probe for Measuring Turbulent Real-Time Shear-Stress Waves	B74-10072	ARC
James R. Rogers and Ray M. Elam, ARC	Cushion Module for Stowing Electronic Equipment	B74-10073	ARC
Philip R. Nachtsheim, David L. Pearson and John T. Howe, ARC	Volume-Reflecting Dielectric Heat Shield	B74-10074	ARC
Samuel J. Troutman, Jr., and James F. Annis, Webb Associates	Programmed-Pressure Air Supply for Positive-Pressure Breathing System	B74-10075	ARC
J.R. Admire, MSFC, and E.J. Kuhar, Jr.; and C.V. Stahle, Jr., General Electric Co.	Dynamic Transformation Method	B74-10076	MSFC
Robert A. Rhein and John D. Ingham, Caltech/JPL	New Polymer Systems: Chain Extension by Dianhydrides	B74-10077	NPO
R.R. Lovell, N.J. Stevens and D.D. Renz, LeRC	Very High Voltage Latching Relay	B74-10079	LeRC
Charles W. Kurvin, Radiation, Inc.	Time-Control System for Communication Between Data-Collection and Orbiting Satellites	B74-10088	GSFC
Donald H. Fryklund, Accumetrics Corp.	Piezoelectric Relay	B74-10089	GSFC
James A. Hutchby, LaRC	Efficiency Increased in New Solar Cell: A Concept	B74-10090	LaRC
M.C. Redman, W.S. Rowe and B.A. Winther, The Boeing Co.	Prediction of Unsteady Aerodynamic Loadings Caused by Trailing-Edge Control-Surface Motions in Subsonic Compressible Flow	B74-10091	LaRC
M.C. Friedell and A.J. Anderson, Martin Marietta Corp.	Heat-Transfer Thermal Switch	B74-10092	LaRC
Moiez A. Tapia, Georgia Institute of Technology	Generalized Current Distribution Rule	B74-10093	LaRC
Harry W. Broskie, Ernest E. Brucher, Frank K. Gough, Jr.; Stephen J. Katzberg and Harris B. Pate, Jr.; LaRC	Viewgraph Preparation Made Easier	B74-10094	LaRC
L.J. Leger, JSC	Detection of Cracks in Surface Insulation	B74-10095	JSC
K.P. O'Kelly and A.B. Featherston, LTV Aerospace Co.	In-Process Oxidation Protection in Fluxless Brazing or Diffusion Bonding of Aluminum Alloys	B74-10096	JSC
Richard B. Kolby, Caltech/JPL	Pocket-Size Microwave Radiation Hazard Detector	B74-10097	NPO
Robert B. Crow, Caltech/JPL	Frequency Discriminator/Phase Detector	B74-10098	NPO
Robert K. Yasui, Caltech/JPL	Facility for Testing Solar Cells	B74-10099	NPO
Joseph Maserjian and John R. Gatewood, Caltech/JPL	Thin-Film Temperature Sensor	B74-10100	NOP
William L. Kuriger, Cal Tech/JPL	Short-Range Laser Obstacle Detector	B74-10101	NPO
Raymond C. Woodbury, Caltech/JPL, and Robert B. Nakich, Time Zero Corp.	Laser-Scanning Techniques for Rapid Ballistics Identification	B74-10102	NPO
Charles D. Baker, Caltech/JPL	Compact Telemetry Package for Remote Monitoring of Neuron Responses in Animals	B74-10103	NPO
Robert B. Crow and Robert C. Tausworthe, Caltech/JPL	Third-Order Phase-Locked Loop Receiver	B74-10104	NPO

NASA TECH BRIEFS—Cont.

Lance G. Hays, Caltech/JPL	Shutoff and Throttling Value	B74-10105	NPO
Patrick J. Hand, Caltech/JPL	Temperature Compensation of Digital Inertial Sensors	B74-10106	NPO
Alex Shumka, Caltech/JPL	Improved Solid-State Triode Construction	B74-10107	NPO
Charles G. Miller, Caltech/JPL	Improved Dispensing Targets for Ion Beam Particle Generators	B74-10108	NPO

PATENTS AND INVENTIONS RESULTING FROM NASA RESEARCH

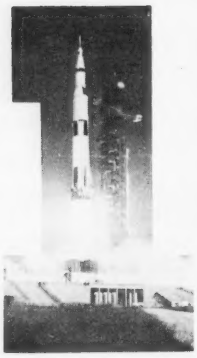
(The Office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel for the indicated installation.)

Inventor(s) and Employer	*Title and NASA Docket*	*Patent No.*	*Installation*
Edwin S. Hochmair, National Academy of Sciences, Washington, DC	Integrated P-Channel Mos Gyrator (MFS-22,343-1)	2,840,829	MSFC
John D. DiBattista, NASA/LaRC	Determining Particle Density Using Known Material Hugeniot Curves (LAR-11;059-)	3,842,656	LaRC
Standord Ollendorf, NASA/GSFC	Structural Heat Pipe (GSC-11,619-1)	3,847,208	GSFC
Wilbur C. Heier, NASA/GSFC	Structural Heat Pipe Mold (LAR-0,782-2)	3,847,208	LaRC
Judd R. Wilkins and Stacey M. Mills, NASA/LaRC	Automated Inoculating Apparatus (LAR-11,074-1)	3,850,754	LaRC
Philip W. Tashbar, NASA/MSFC	System for Depositing Thin Films (MFS-20,775-1)	3,847,115	MSFC
Charles W. Kurvin, Radiation, Inc., Systems Div., Melbourne, FL	Remote Platform Power Conserving System (GDC-11,182-1)	3,851,250	GSFC
James M. Hoop, NASA/MSFC	Ultrasonic Bone Densitometer (MFS-20,994-1)	3,847,147	MSFC
Clifford Burdin, McDonnell Douglas Corp., Huntington	Phase-Locked Servo System (MFS-22,073-)	3,851,238	MSFC
Raymond L. Furner, National Academy of Sciences, National Research Council, Washington, DC	Automated Analysis of Oxidative Metabolates (ARC-10,469-1)	3,846,243	ARC
Bruce Flagge, NASA/LaRC	Electro-Mechanical Sine/Cosine Generator (LAR-11,389-1)	3,849,720	LaRC
John R. Hollahan and Theodore Wydeven, National Academy of Sciences, Washincton, DC	Water Purification Membranes and Method of Preparation (ARC-10,643-1)	3,847,675	ARC
Walter H. Houck and Jon D. Stigberg, NASA/KSC	Signal Conditioner Test Set (KSC-10,750-1)	3,848,190	KSC
Klaus Heinemann, National	Electron Microscope Aperture System (ARC-10,448-2)	3,847,689	ARC
Michael A. Gedwill and Salvatore J. Grisaffe, NASA/LeRC	Method of Protecting the Surface of a Substrate (LEW-11,696-1)	3,849,865	LeRC
John A. Woollam, NASA/LeRC, and Harry A. Beale and Ian L. Spain, Univ of Maryland	Hall Effect Magnetometer (LEW-11,632-2)	3,849,875	LeRC
Vernon D. Gebben and John A. Webb, Jr., NASA/LeRC	Circuit for Detecting Initial Systole and Dictortic Notch (LEW-11,581-1)	3,850,169	LeRC
Clarence H. Heckler, Jr., Paul D. Baba and Nutan C. Bhiwandker, Ampex Corp.; Redwood City, CA	Method for Making Conductors for Febrite Memory Arrays (LAR-10,994-1)	3,849,877	LaRC
Dan H. Dane, NASA/MSFC	Orthotic Arm Joint (MFS-21,611-1)	3,849,668	MSFC

1974 LAUNCH SCHEDULE

Name	*Launch Date*	*Vehicle*	*Range*	*Mission/Remarks*	
Skynet II-A (UK)	Jan. 18	Delta	ETR	Reimbursable launch. United Kingdom's communications satellite.	Unsuccessful
Centaur Proof Flight	Feb. 11	Titan III–E Centaur	ETR	Test flight of booster planned for Viking Mars launch in 1975.	Unsuccessful Engine failure
San Marco (SM–C2)	Feb. 18	Scout	SM	United States/Italy cooperative mission to conduct air density measurements.	Launched
UK X–4	Mar. 8	Scout	WTR	Reimbursable launch. United Kingdom technology satellite with experiments related to spacecraft power systems, altitude control and stabilization.	Successful
WESTAR–A	April 13	Delta	ETR	Western Union Communications Satellite. Reimbursable launch.	Successful
SMS–I	May 17	Delta	ETR	First prototype/developmental mission for geostationary meteorological operational satellite system; day and night continuous imaging of cloud cover; sophisticated remote-platform data-collection-and weather data relay.	Launched
ATS–6	May 30	Titan III–C	ETR	Developmental and demonstrative communications mission using technology applicable to terrestrial and space needs; utilizes 9.15-meter (30-foot) deployable parabolic antenna and communications system with frequencies in several bands; will support public communications experiments in the U.S. and India.	Successful
Hawkeye (formerly Injun-F)	June 3	Scout	WTR	To study the topology of the magnetic field at large radial distance over the Earth's dgear caps and the interaction of the solar winds with the geomagnetic field.	Launched
AEROS-B (German)	July 15	Scout	WTR	Spin-stabilized, Earth-orbiting satellite designed for upper atmosphere measurements.	Successful
Netherlands Sat.-A (ANS-A)	August 27	Scout	WTR	Designed to obtain data from celestial X-ray and ultraviolet sources.	Launched
WESTAR-B	Oct. 10	Delta	ETR	Western Union communications satellite. Reimbursable launch.	Successful
UK-5	Oct. 15			To investigate galactic and extra galactic X-ray sources.	Launched
Intelsat IV F-8	Nov. 21	A-Centaur	ETR	One of a series of communications satellites to form part of a global communication commercial satellite system. Launch for COMSAT.	Launched
Skynet II-B (UK)	Nov. 22	Delta	ETR	Reimbursable launch. United Kingdom communications satellite.	Launched
Helios-A	Dec. 10	Titan III-E Centaur	ETR	To investigate the properties of and processes in interplanetary space in the direction of and close to the Sun by developing, launching and operating automated spacecraft.	Launched
Symphonie-A (French/ German)	Dec. 17	Delta	ETRA	Experimental Communications satellite. Reimbursable.	
WESTAR-C	(Under Study)	Delta	ETR	Western Union Communications satellite. Reimbursable launch.	
Intelsat IV F-1	(Under Study)			One of a series of communications satellites to form part of a global communications commercial satellite system. Launch for COMSAT.	
GOES-A (SMS-C)	(Under Study)	Delta	ETR	First Geostationary Operational Environmental Satellite, follow-on to SMS missions, funded by NOAA.	

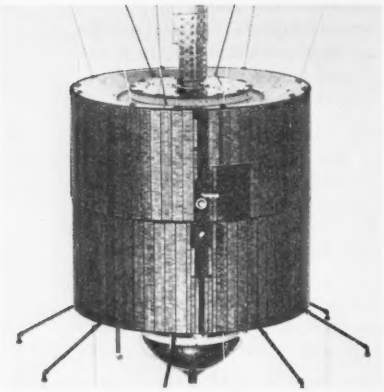
ARE YOU GETTING YOUR

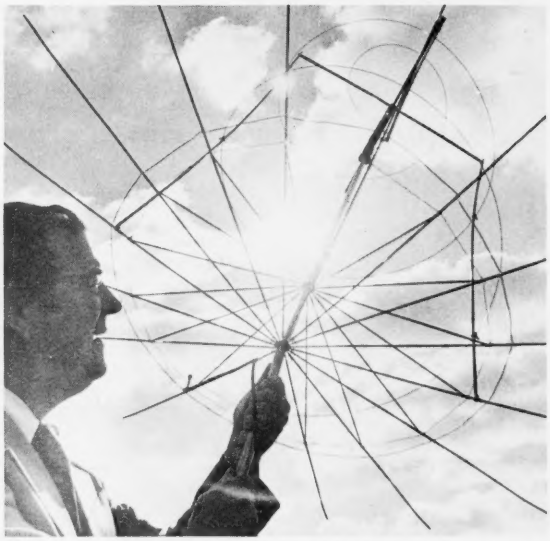


WORTH FROM SPACE?

FOR A PENNY OF YOUR TAX DOLLAR, YOU ARE GETTING ...

A SIMPLE SYSTEM OF TRANSMITTING DISTRESS SIGNALS





Thanks to NASA's communications satellite research, a simple, hand-held radio transmitter may someday relay and receive messages, whether of distress or otherwise, to or from points anywhere in the world.

This concept was demonstrated at NASA Headquarters recently by Roy Anderson of the General Electric Co., an engineer and inventor most responsible for the development. Using a walkie-talkie and a collapsible antenna, shown at right in the hands of Charles W. Mathews, NASA Associate Administrator for Applications, he made contact with ground stations in Buenos Aires, Argentina; Reykjavik, Iceland; Shannon, Ireland; and Schenectady, NY.

First, signals were sent at Morse code rates to NASA's Applications Technology Satellite (ATS-3) (pictured at left) about 25,000 miles away and 22,300 miles above South America, which relayed them to their destinations, more thousands of miles away from the sending point. Answers came back by voice, indicating satisfactory reception—"as if we were in the same room," people in Shannon said.

The surprising feature of the demonstration was the simplicity of the equipment used—except for the satellite—items which can be purchased almost anywhere. The transmitter was a walkie-talkie, weighing three pounds, such as those used by police and firemen and of which 50,000 or so are sold in the U.S. each year. The key to boosting its power to 10,000 times its normal reach was the antenna, also weighing three pounds and fashioned from an ordinary golf umbrella. And the amazing factor about the satellite was that it could handle the signals even though fully saturated with other communications signals.

The most important use of the concept is seen in search and rescue situations. It could be used in times of distress by private boat owners, mountain climbers, airplane pilots, airline and shipping companies, or people in isolated areas.

Anderson and other General Electric engineers have been working with NASA for years on various communications experiments. A system based on the concept demonstrated, for world-wide operation, would require three satellites equally spaced around the globe.

NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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